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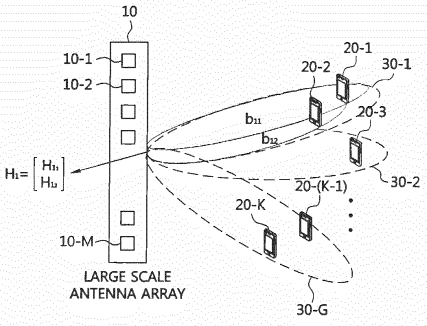
(54) Method for multi-input multi-output communication in large-scale antenna system

(57) Disclosed is a method for multi-input multi-output transmission of a base station in a wireless communication system. The method includes obtaining channel information of one or more terminals, classifying the one or more terminals into one or more classes and one or more groups dependent on the class based on the channel information, determining a group beamforming matrix for each of the one or more groups, performing group beamforming transmission on terminals belonging to each of the one or more groups based on the group beamforming matrix, obtaining single user-channel quality indicator (SU-CQI) information and interference signal information of each of the terminals belonging to each of the one or more groups, and scheduling the terminals based on the SU-CQI information and the interference signal information.

FIG. 1



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EUROPEAN SEARCH REPORT

Application Number
EP 14 15 8561

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	WO 2011/138979 A1 (PANTECH CO LTD [KR]; LI JIANJUN [KR]; PARK KYOUNGMIN [KR]) 10 November 2011 (2011-11-10) * paragraphs [0018], [0033], [0034], [0086] - [0098]; figure 1 *	1,17 2-5,14	INV. H04B7/04 H04B7/06
Y	JUNYOUNG NAM ET AL: "Joint spatial division and multiplexing: Realizing massive MIMO gains with limited channel state information", INFORMATION SCIENCES AND SYSTEMS (CISS), 2012 46TH ANNUAL CONFERENCE ON, IEEE, 21 March 2012 (2012-03-21), pages 1-6, XP032241512, DOI: 10.1109/CISS.2012.6310934 ISBN: 978-1-4673-3139-5 * page 2 - page 4 *	2-5	
Y	Ansuman Adhikary ET AL: "Joint Spatial Division and Multiplexing", , 6 September 2012 (2012-09-06), XP055124712, Retrieved from the Internet: URL:http://arxiv.org/abs/1209.1402 [retrieved on 2014-06-24] * pages 5,10,20 - pages 26,32-33 *	2-5,14	TECHNICAL FIELDS SEARCHED (IPC) H04B H04L H04W

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
Munich	24 June 2014	Franz, Volker

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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Application Number
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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-5, 14, 17

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 14 15 8561

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-5, 14, 17

The channel information includes at least one of a transmit correlation matrix, an eigenvalue, an eigenvalue, an angle speed, an angle of departure and at least one long period precoding matrix indicator selected from a fixed codebook.
Terminals having similar transmission correlation matrices to each other are classified into the same group.
Terminals whose effective eigenvectors are similar are classified into the same group.
The group beamforming matrix is determined through a block diagonalization.
Transmitting using a rank that is different from a rank related to the SU-CQI information.

1.1. claim: 14

Calculating MU-CQI information and a sum-proportional fair metric based on the MU-CQI; selecting a multi-user combination having a largest sum-PF metric in each class as a sum-PF metric of each class.

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2. claims: 6-8, 15, 16

Group-specific reference signals are beamformed using a plurality of beam vectors orthogonal to each other between groups are transmitted though single resource element.
Scheduling terminals having interference less than predetermined threshold to share same demodulation reference resources on different scrambling identities.

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3. claims: 9-13, 18-25

Feeding back the interference signal information to a base station.
The interference signal information includes at least one of the following:
- intensity of an interference signal between terminals
- offset value with respect to the SU-CQI
- CQI represented as modulation and coding scheme
- Interference intensity of a precoding matrix indicator serving as interference with the terminals belonging to the group
- ratio with respect to the SU-CQI
- PMI whose inner product with a PMI selected by the terminal is smaller than a predetermined value among PMIs that serve as interference with the terminal
- interference signal information about a sub-band whose intensity is smaller than a predetermined value among

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sub-bands

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 14 15 8561

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011138979 A1	10-11-2011	KR 20130073021 A	02-07-2013
		WO 2011138979 A1	10-11-2011

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82